



# Dance Is a Healing Art

Linda Cox, MD, FAAAAI<sup>1,2\*</sup>,

Jodi Youmans-Jones, BA, MFA<sup>3</sup>

## Address

<sup>\*,1</sup>Department of Medicine and Dermatology, Nova Southeastern University,  
Ft. Lauderdale, USA

Email: lindaswolfcox@msn.com

<sup>2</sup>Casper, USA

<sup>3</sup>Department of Theatre and Dance, Casper College, Casper, USA

© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2023

Keywords Dance · Healing · Well-being · Neurological function · Cognitive function · Dementia · Parkinson's disease · Depression · Neuroplasticity

## Opinion Statement

The purpose of this review is to evaluate the health benefits of dance and dance therapy in various health domains. Dance interventions included movement therapy with certified therapists, common dances such as ballroom dancing, salsa, and cha-cha as well as ethnic dances, such as the Chinese Guozhuang Dance and the Native American jingle dance. The health domains included depression, cognitive function, neuromotor function, dementia, balance, neurological growth factors, and subjective well-being. The National Library of Medicine, Congress of Library, and the Internet were searched using the terms: dance, dance movement therapy, health, cognitive function, healing, neurological function, neuromotor function, and affective disorders from 1831 to January 2, 2023. Two-thousand five hundred and ninety-one articles were identified. Articles were selected if they provided information on the health benefits of dance in one or more of the above domains as compared to a “non-dance” control population. Studies included systematic reviews, randomized controlled studies, and long-term perspective studies. Most of the subjects in the studies were considered “elderly,” which was generally defined as 65 years or older. However, the benefits of DI on executive function were also demonstrated in primary school children. Overall, the studies demonstrated that DI provided benefits in several physical and psychological parameters as well as executive function as compared with regular exercise alone. Impressive findings were that dance was associated with increased brain volume and function and neurotrophic growth function. The populations studied included subjects who were “healthy” older adults and children who had dementia, cognitive dysfunction, Parkinson's disease, or depression.

## Abbreviations

aMCI	Amnesic MCI
DI	Dance intervention
DMT	Dance movement therapy
EAI	Exercise-induced asthma
MCI	Mild cognitive impairment
RCT	Randomized-controlled trials
WHO	World Health Organization

## Introduction

The purpose of this paper is to explore dance as a healing art from a historical and modern-day perspective. Dance has played a significant role in the spiritual [1] and social development of most communities throughout the world at some point in history. Dance embodies many curative properties that are released through movement, rhythms, self-expression, and communion [2]. These properties allow individuals to shift emotional states, which can provide a mechanism for therapeutic cathartic release. Dance can induce alternating mood states, ranging from reduced arousal leading to a tranquil state or increased arousal leading to resulting in cathartic release [2]. Ritualistic dance can be used to induce a dissociated state of consciousness (i.e., trance), during which the participants may experience internal bliss and elation. Dance rituals can allow psychologically or socially unacceptable impulses to be expressed and worked through subliminally, allowing individuals to experience chaos, fear, or anxiety symbolically. The sublimated symbols can be further explored through dance by individuals or a group. The Native American "Jingle Dance." The jingle dress is a prayer or medicine dance to help heal afflicted people (see Fig. 1). Most stories point to the origins among the Ojibwe of the Minnesota-Ontario boundary area, circa 1900 to 1920. Noticeably, the rows of decorative metal cones hang about 1 in. from the dresses and clink together as the dancer moves. The traditional jingle dress dance requires the dancer to not cross her feet, not dance in a backward moving direction, and not complete a circle dance movement. She kept her footwork light, agile, and close to the ground. The contemporary jingle dress dance allows more fluidity; the dancer may cross her feet, complete full circle

dance movement, and may dance in a backward direction. Contemporary dresses are designed so the dancer may move more freely, but the metal decorative cones remain (see Fig. 1). Additionally, contemporary dancers often carry an eagle feather fan during their dance. The jingle dress dance grew in popularity and cultural significance from the 1920s to around the 1950s only to experience a decline and then rise back to life in the 1980s with the advent of powwow expansion and dance competition.

One story of how the jingle dress originated is during World War 1. An Ojibwe girl became very sick, possibly from the widespread Spanish influenza epidemic. Her father feared he was going to lose her and sought the Creator through prayer for a vision or dream to save his daughter. His prayers were answered, and he saw the dress and the vision for the healing dance. He obeyed his vision by constructing the jingle dress and putting the dress on his sick daughter. He instructed his daughter on how to move her feet and body, for the healing dance, and as she followed her father's guidance and danced, she was cured. The healed Ojibwe girl sought out other girls, showing them how to make a jingle dress in the four sacred colors (red, yellow, white, and blue), with four rows of jingles made from tobacco, and can tops. The healed Ojibwe girl and three other girls became the heart of the Jingle Dress Dance Society [1].

There is a physiological basis for the psychological health benefits of dance and some evidence for greater benefits with dance intervention. The physiological effects of moderate-intensity physical exercise include the production of nerve growth factors, neurotrophic factors and angiogenesis, and increased cerebral blood



**Fig. 1** The jingle dance (<https://www.dreamstime.com/stock-photo-young-powwow-jingle-dress-dancer-image12914520> [31])

flow [3]. Sustained moderate-intensity physical exertion exerts an anti-inflammatory and pro-(neuro) regenerative effect, which can translate into improved cognitive and motor functions in aging and

neurological disorders [4••]. There is evidence indicating greater benefits with group dance as compared with individual dance movement [5].

## Dance and allergic disease

Asthmatic children experience a decline in lung function known as exercise-induced asthma (EIA). This is determined and graded with the lung function tests before and after submaximal workloads on the ergometer cycle or the treadmill. EIA appears in asthmatic individuals with entirely normal lung function before the effort. It may also become clinically manifest with exercise in patients who have a subclinical degree of obstruction. The grade of EIA is essentially dependent on the duration and intensity of effort but also on

the type of exercise. At the Voksentoppen Allergy Institute, they found that 85% of children develop a fall in lung function of 15% or more after a 6 min ergometer cycle test, which could be totally or partially abolished by prophylactic medication 10 min before the start of the test. Disodium cromoglycate (Intal) and/or beta-adrenergic drugs are regularly used before all physical activity. Training programs based on the interval principle such as swimming, ball games, relay races, and dancing are useful activities in the training and rehabilitation of children and adolescents with asthma. Through prophylactic medication and physical training (dance), the aerobic work capacity, muscle strength, and lung function in asthmatic children are improved. Training also leads to a significant mobilization of mental resources and an increase in social integration [6]. Aerobic dance has been demonstrated to be a therapeutic exercise for asthmatic patients [7].

Factors which can impact on confidence include a chronic health condition such as asthma, poor motor skills, and being overweight. Increasing levels of physical activity have obvious benefits for children with asthma and children who are overweight, but few activity interventions with children specifically target children with low exercise self-efficacy. A clustered (at the level of school) RCT will be used to compare a targeted, 10 week, stepped activity program (activity diary, dance DVD, circuit-training, and motivational interviewing) that was designed to promote exercise self-efficacy [8].

## Dance and pain threshold

In a study designed to examine the independent and interacting effects of synchrony and exertion on perceived social bonding and pain threshold, a proxy for endorphin release, two hundred and sixty-four high school students were randomized to one of four movement groups: high exertion synchrony; high exertion partial synchrony; low exertion synchrony; low exertion partial synchrony. [9] In synchrony conditions, all participants performed the same movements to the same music at the same time. High exertion involved full-body dance movements while standing and low exertion involved small hand gestures performed while seated. The study found that synchrony and exertion had significant independent positive effects on pain threshold and in-group bonding. In a subsequent study, the same investigators employed a "silent disco" paradigm to compare the effect of synchronous and non-synchronous dance on pain threshold and social bonding [10•]. Ninety-four subjects were randomly assigned to one of three dance movement groups: synchrony, partial synchrony, and asynchrony. In groups of four strangers, each participant would perform the dance by listening to the music on an individual headphone (silent disco technology). The pain threshold was measured by inducing ischemic pain with a blood pressure cuff. Social closeness was measured using a 7-point Likert scale questionnaire. A significant improvement in the pain threshold (i.e., higher) was only seen in the synchrony group. In contrast, the partial synchrony group had a lower pain threshold at the end of the study. Both groups had a significantly higher closeness index, but the

increase was higher in the synchrony group. There was no significant change in either parameter in the asynchrony group. Although these studies did not compare individual dance with dance performed as a group, they provide indirect evidence that there may be a greater health benefit of group dance.

In another study, the feasibility of music delivered by silent disco headphones was acceptable to a sample of inpatients staying in an older adult mental health unit of a large urban hospital [11]. The study employed a video-ethnographic design in data collection, including conversational interviews and observations with video recordings among ten patient participants in a hospital unit. A focus group was conducted with ten hospital staff on the unit.

The analysis identified three themes that represented the experiences of patients and staff: [1] perceived usefulness, [2] perceived ease of use, and [3] attitude. Patient participants reported that the music delivered by the headphones brought positive benefits. Witnessing the positive effects on patients influenced the staff's view of how music could be used in the clinical setting to support patients' well-being.

The authors concluded that music delivered by the silent disco headphones in an older adult mental health unit was found to be an acceptable and feasible intervention for patients. Leadership support is identified as an enabling factor in supporting technology adoption in the clinical setting. The findings should be used to inform practice development and future research.

In non-Westernized cultures, dance as a healing art remains a tradition, especially in African societies. In many tribal cultures, dance rituals are an essential part of the healing process, particularly in relieving the symptoms of psychological distress. They play an integral role in socialization, expression, and community, which helps maintain societal health [2]. In contrast, the application of dance as a healing art has largely been obscured and ignored in Western culture.

An example of a dance healing ritual in current use is the Senegalese Ndeup ritual. It is a tribal therapeutic ritual for depression [12]. The person suffering from depression is thought to be possessed by the spirits who have established a contract with the community's original ancestors. It is practiced by the Senegalese's Lebou fishing community and the Wolof and Serer ethnic groups as a means of reconciling with their ancestors' spirits [2]. The ceremony usually lasts between 4 to 8 days. It is organized by the priest, but it is open to the entire community. During the ceremony, the "patient" is massaged with milk, millet, and the blood of the sacrificed animals. Ritual words are recited while pouring blood on the patient. Throughout, there are drums and ritual songs. During the ceremony, the patient may suddenly become alert and begin to dance or go into a trance state, and the priest may do the same. In an article entitled "Treating Depression with Tribal Wisdom," an American who suffered for years with depression described the Ndeup ritual as an astonishing experience [12]. He noted that it was probably better than many forms of group therapy in the United States (USA). The article interviews a Rwandan man who explains the health benefits of the Ndeup ritual, "We had a lot of trouble with Western mental health workers, especially the ones who came here right after the genocide." They came, and their practice did not involve being outside in the sunshine which is, after all, where you begin to feel

better. There was no drumming or music to get your blood flowing again—when you are depressed and low, you need to have your blood flowing. There was no sense that everyone had taken the day off so that the entire community could come together to lift you up and bring you back to joy. There was no acknowledgment of the depression as something invasive and external that could be cast out of you again. Instead, they would take people one at a time into these dingy little rooms and have them sit around for an hour or so to talk about bad things that had happened to them. We had to ask them to leave the country.

Historically, dance rituals were an integral part of Native American societal systems. However, tribal dance was essentially banned after the Native Americans were defeated by the US Army. At present time, dance serves primarily to continue cultural traditions. Many tribes continue to perform their healing and other ritual dances in powwows and other ceremonies for show and competition. One of the dances frequently performed in powwow competitions is the jingle dance. This is a dance performed by females who are costumed in an ornate dress with sewn-on metal cones that create a jingling noise when they dance. The dance is based on the story of a medicine man, who cured his sick daughter with a sacred healing dress from the Creator [13]. A recent Montana newscast featured an eleven years old, performing the jingle dance at sunset to appeal to the Creator to heal the coronavirus pandemic [14].

A recent study examined the influence of Guozhuang Dance on the subjective well-being of older adults in China (see Table 1) [15••]. According to the article information released from the World Health Organization (WHO) in October 2021, the population of people over the age of 60 in the world's total population will reach 22% by 2050, and 80% of older adults will live in low- and middle-income countries. The study recruited 528 adults (male = 228, female = 292) aged 65 years or older who participated in Guozhuang Dance to complete a survey that evaluated the effect of this exercise on their subjective well-being. The study demonstrated that it had a positive effect on enhancing the subjective well-being through the chain mediating effect of group identity and self-efficacy. The authors concluded that the measures should be taken to encourage older adults to participate in Guozhuang Dance (see Fig. 2). A number of other studies have demonstrated the health benefits of different style of dance [16–23].

In Western culture, dance has primarily been viewed as a form of recreation or entertainment, and it has played little role in healing. However, there have been significant developments in health applications for dance in the past 40 years, and there is a growing evidence and recognition of the therapeutic benefits of dance in disease prevention and rehabilitation [24]. Dance is an inherently multi-modal intervention that involves psychological, musculoskeletal, and neurological processes, which can impact multiple domains, such as procedural learning, attention, memory, coordination, rhythm, balance, and gait. There is mounting evidence that it can be therapeutic in many cognitive, mood, and neurological orders. Recent studies suggest dance may improve brain function in healthy adults.

Another study evaluated whether dancing could increase the hippocampal volume of senior amnesic mild cognitive impairment which is thought to be a precursor to dementia [25•]. The aim of this study was to investigate



**Fig. 2** Picture of the Guozhuang Dance (from:[https://www.dreamstime.com/search.php?securitycheck=f9285f61fcf7cba9ba9126ddc1d7432e&firstvalue=&lastsearchvalue=&srh\\_field=guozhuang&s\\_ph=y&s\\_il=y&s\\_video=y&s\\_audio=y](https://www.dreamstime.com/search.php?securitycheck=f9285f61fcf7cba9ba9126ddc1d7432e&firstvalue=&lastsearchvalue=&srh_field=guozhuang&s_ph=y&s_il=y&s_video=y&s_audio=y) [32])

the influence of aerobic dance on hippocampal volume and cognition after 3 months of aerobic dance in older adults with aMCI. In this RCT, 68 elderly people with aMCI were randomized into the aerobic dance group: 35 participants (mean age:  $71.5 \pm 6.6$  years) and 33 participants (mean age:  $69.8 \pm 7.7$  years) into the control group. Ultimately, 62 of 68 participants completed this study, and the MRI data of 54 participants were included. A specially designed aerobic dance routine was performed by the dance group three times per week for 3 months, and MRI with a 3.0 T MRI scanner and cognitive assessments was performed before and after intervention. High-resolution three-dimensional (3D) T1-weighted anatomical images were acquired for the analysis of hippocampal volume. A multiple linear regression model was used to detect the association between intervention and the difference of hippocampal volumes and cognitive scores at baseline and after 3 months. The intervention group showed greater right hippocampal volume (beta [95% CI]: 0.379 [0.117, 0.488],  $p = 0.002$ ) and total hippocampal volume (beta [95% CI]: 0.344 [0.082, 0.446],  $p = 0.005$ ) compared to the control group. No significant association of age or gender was found with unilateral or global hippocampal volume. There was a correlation between episodic memory and intervention, as the intervention group showed a higher Wechsler Memory Scale-Revised Logical Memory (WMS-RLM) score (beta [95% CI]: 0.326 [1.005, 6.773],  $p = 0.009$ ). Furthermore, an increase in age may cause a decrease in the Mini-Mental State Examination (MMSE) score (beta [95% CI]:  $-0.366 [-0.151, -0.034]$ ,  $p = 0.002$ ). In conclusion, 3 months of aerobic dance could increase the right and total hippocampal volumes and improve episodic memory in elderly persons with aMCI.

The benefits of dance intervention are not limited to the elderly population. One study examined the effect of an aerobic dance program as part of physical education classes on aspects of primary school children's executive functions (inhibition, working memory, and cognitive flexibility) [26•]. Participants were 41 children (21 boys and 20 girls; M age = 10.30, SD = 0.50 years) who were divided into a DI group and a non-DI control

group. The DI followed an aerobic dance intervention as part of their physical education program (45 min sessions, 2 days per week for over 8 weeks). Participants in both groups performed executive function tests before and after the intervention period to evaluate their mental flexibility, inhibition, and working memory. The study revealed a significant effect of the aerobic dance program on participants' cognitive flexibility (i.e., on Trail Making Tests (B-A) times and committed errors) ( $p < 0.001$ ) and on Stroop measures of inhibition (corrected number of words and corrected errors) ( $p < 0.001$  and  $p < 0.01$ ), respectively. Post hoc analyses demonstrated that DI was associated with improved performance in the working memory (digit recall score) from pre-test to post-test and in comparison to the non-DI group ( $p < 0.001$ ). The authors concluded that 8-week aerobic dance program promoted executive function development in primary school children.

A systematic review of randomized controlled trials investigating the effect of dance practice on the neuroplasticity of mature brains identified eight studies with 889 subjects (562 women, 299 men), aged from 18 to 94 years old, seven of which were conducted in normal subjects and one in patients with mild cognitive impairment (see Table 2) [27••]. Neuroplasticity was assessed with the following parameters: brain volume and structure, brain function, psychomotor adjustment, and production of neurotrophic factors. Dance interventions included social dance, ballroom dance, new choreographic sequences of different dance genres, and a specialized dance program designed for elderly people called Agilano™. The study found that compared with conventional exercise, dance intervention had better outcomes in terms of psychosocial, posture, and balance parameters. Dance interventions were also associated with positive brain structural and/or functional changes in the brain, e.g., increase in hippocampal, gray matter, and parahippocampal gyrus volume as well as white matter integrity. The authors concluded that dance practice integrates brain areas to improve neuroplasticity.

Another comprehensive review entitled "Dance and Aging: A Critical Review of the Finding" evaluated the impact of dance intervention on three major domains: (1) cognition, (2) sensorimotor performance, and (3) underlying neurobiological factors [24]. The dance interventions studied evaluated ballroom dance, ballet, tango, several cultural dances, and dance/movement therapy. The study identified forty-four studies that included the healthy elderly population and those exhibiting neurological impairment, i.e., Parkinson's  $N = 7$ , dementia  $N = 7$ , and brain injury  $N = 1$ . Twenty-one studies investigated the effect of dance on cognition, twenty-seven evaluated the effect on sensorimotor performance, and seven evaluated the effects on underlying neurological factors. In the six studies of healthy individuals, dance intervention, which included social, ballroom, aerobic, and Turkish folklore dance, was associated with improvements in cognitive and sensorimotor performance. Six studies evaluated the impact of dementia using six different dance interventions and outcome assessments. Dance movement therapy resulted in improved visuospatial ability and planning. Circle dancing was associated with improved cognitive function and mood. Waltz was associated with improved procedural learning. The longest and largest study evaluated the impact of dance as a leisure activity in a population of 469

subjects who were followed for 21 years [28•]. Dance was the only physical activity that showed a significant association with a lower risk of dementia.

Another systematic review evaluated the effect of dance and dance movement therapy (DMT) on health-related psychological outcomes [29••]. They identified 41 studies (dance intervention  $N=20$ ; DMT  $N=21$ ) from January of 2012 and March of 2018, which included a total of 2374 subjects [29••]. In the DMT cluster, the overall medium effect was small, significant, and homogenous/consistent. The overall medium effect of the dance intervention cluster was large, significant, and heterogeneous/non-consistent. The authors noted that the difference in population made comparisons difficult because most dance intervention studies came from preventive contexts, and most DMT studies came from institutional healthcare contexts with more severely impaired clinical patients. This study suggested that DMT and dance interventions impacted different domains; DMT decreased depression and anxiety and increased quality of life and interpersonal and cognitive skills, whereas dance interventions increased (psycho-)motor skills.

Dance has also been used to help patients cope with a serious, life-threatening illness such as cancer or AIDS. Halprin is a dancer, teacher, and facilitator of dance as a healing art. She is also a cancer survivor. In her book "Dance as a Healing Art," she discusses a dance-based program that she developed to assist cancer patients in coping with their illness [30]. The program utilizes imagery and sensory awareness with a focus on breathing and pulse-beat. The book outlines the nine-lesson plans of the program, which have unique titles, e.g., "Finding you Animal Ally" or "The Immune System Drama." All lessons begin with a "check-in," during which the participants speak about the nature of their illness and their expectations of the program. Initially, "check-in" is done in a circle format with the entire group, but this can be adapted as the series progresses. For example, one can check-in with a partner, who will report back to the groups, or one can use gestures or images to convey their experiences of the movement. In the chapter entitled "The Next Step in Healing," Halprin says "I imagine that when we begin to understand dance as a healing art, there will be a natural growth as community art." This will be the next step in the evolution of reclaiming dance as a useful part of our lives [30].

## Conclusion

---

A meta-analysis evaluated the effectiveness of dance movement therapy (DMT) and dance interventions for psychological health outcomes. Results suggest that DMT decreases depression and anxiety and increases quality of life and interpersonal and cognitive skills, whereas dance interventions increase (psycho-)motor skills. Larger effect sizes resulted from observational measures, possibly indicating bias. Follow-up data showed that on 22 weeks after the intervention, most effects remained stable or slightly increased. Consistent effects of DMT coincide with findings from former meta-analyses. Most dance intervention studies came from preventive contexts, and most

DMT studies came from institutional healthcare contexts with more severely impaired clinical patients, where there were smaller effects. However, they had a higher clinical relevance [31].

As the evidence demonstrating dance interventions that are associated with measurable improvements in objective and subjective parameters continues to emerge, it is likely that dance, whether in the form of dance movement therapy or dance itself, will eventually become an integral part of traditional Westernized medicine, instead of being a homeopathic alternative. Initially, it will become an accepted therapy for specific conditions. Over time, dance interventions will likely be employed as a proven preventive measure, much like daily aspirin is prescribed for coronary artery disease prophylaxis. Significant benefit of aspirin over placebo was shown for aspirin 600/650 mg, 1000 mg, and 1200 mg, with numbers needed to treat for at least 50% pain relief of 4.4 (4.0–4.9), 4.0 (3.2–5.4), and 2.4 (1.9–3.2) respectively [32].

“Numbers needed to treat” is the number of patients treated with a certain drug that results in one patient with a defined degree of relief. The NNT of drugs permits a comparison between different drugs and diseases to better judge the efficacy of an agent. Usually, the NNT > 50% pain relief is utilized because it is easily understood and seems to be related to relevant clinical effect.

The “numbers needed to harm” (NNH) is the number needed to treat with a certain drug before a patient experience a significant side effect. The drugs with a low NNT/NNH ratio are superior to the drugs with a high NNT/NNH ratio. One study demonstrated that Creative Dance and stretching may both benefit fitness and balance for older adults; however, CD may improve dynamic balance and mobility more than stretching. Therefore, CD may be a creative physical activity that contributes to successful aging [33].

## Declarations

---

### Conflict of Interest

The authors declare no competing interests.

### Human and Animal Rights and Informed Consent

This paper does not contain any human or animal studies performed by any of the authors.

## References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Sky S. The jingle dance. 2023. <https://sistersky.com/blogs/sister-sky/the-healing-dance-native-american-jingle-dress>. Accessed 1/2/23.
2. Monteiro NM, Wall DJ. African dance as healing modality throughout the diaspora: the use of ritual and movement to work through trauma. *J Pan African Stud*. 2011;4:234–52.
3. Deslandes A, Moraes H, Ferreira C, Veiga H, Silveira H, Mouta R, Pompeu FA, Coutinho ES, Laks J. Exercise and mental health: many reasons to move. *Neuropsychobiology*. 2009;59:191–8.
4. Cobianchi S, Arbat-Plana A, Lopez-Alvarez VM, Navarro X. Neuroprotective effects of exercise treatments after injury: the dual role of neurotrophic factors. *Curr Neuropharmacol*. 2017;15:495–518.
5. Goldman J. Why dancing leads to bonding. In *Scientific American*. 2022. <https://www.scientificamerican.com/article/why-dancing-leads-to-bonding/>.
6. Oseid S. Asthma and physical activity. *Scand J Soc Med Suppl*. 1982;29:227–34.
7. Wolf SI, Lampl KL. Pulmonary rehabilitation: the use of aerobic dance as a therapeutic exercise for asthmatic patients. *Ann Allergy*. 1988;61:357–60.
8. Glazebrook C, Batty MJ, Mullan N, Macdonald I, Nathan D, Sayal K, Smyth A, Yang M, Guo B, Hollis C. Evaluating the effectiveness of a schools-based programme to promote exercise self-efficacy in children and young people with risk factors for obesity: steps to active kids (STAK). *BMC Public Health*. 2011;11:830.
9. Tarr B, Launay J, Cohen E, Dunbar R. Synchrony and exertion during dance independently raise pain threshold and encourage social bonding. *Biol Lett*. 2015;11.
10. Tarr B, Launay J, Dunbar RI. Silent disco: dancing in synchrony leads to elevated pain thresholds and social closeness. *Evol Hum Behav*. 2016;37:343–9.
11. Hung PhD Rn L DBK, Peake G, Poljak L, Wong L, Mann Lld J, Wilkins-Ho Md M, Chaudhury PhD H. Implementing silent disco headphones in a hospital unit: a qualitative study of feasibility, acceptance, and experience among patients and staff. *SAGE Open Nurs*. 2021 May 30;7:23779608211021372.
12. Taljaard T. Treating depression with tribal wisdom. 2015. <https://upliftconnect.com/treating-depression-with-tribal-wisdom/>. *Uplift* accessed 10/18/20.
13. Sexsmith P. The healing gift of the jingle dance. Aboriginal Multi-Media Society of Alberta (AMMSA). 2003; pp. 28.
14. KPAX-TV. Jingle Dance: [https://youtu.be/A4FYE dFg\\_L0](https://youtu.be/A4FYE dFg_L0). Accessed 11/12/20. In *Jill Valley*, ed. KPAX-TV.
15. Lin Y, Zhao B, Ma X. The Influence of Guozhuang Dance on the subjective well-being of older adults: the chain mediating effect of group identity and self-efficacy. *Int J Environ Res Public Health*. 2022;19.
16. Abreu M, Hartley G. The effects of salsa dance on balance, gait, and fall risk in a sedentary patient with Alzheimer's dementia, multiple comorbidities, and recurrent falls. *J Geriatr Phys Ther*. 2013;36:100–8.
17. Adiputra N, Alex P, Sutjana DP, Tirtayasa K, Manuaba A. Balinese dance exercises improve the maximum aerobic capacity. *J Hum Ergol (Tokyo)*. 1996;25:25–9.
18. Agaronnik N. Musical chairs: using wheelchair ballroom dance in disability education. *JAMA*. 2018;320:14–5.
19. Aguinaga S, Kaushal N, Balbim GM, Wilson RS, Wilbur JE, Hughes S, Buchner DM, Berbaum M, McAuley E, Vasquez PM, Marques IG, Wang T, Marquez DX. Latin dance and working memory: the mediating effects of physical activity among middle-aged and older latinos. *Front Aging Neurosci*. 2022;14:755154.
20. Aguinaga S, Marquez DX. Feasibility of a Latin Dance program for older Latinos with mild cognitive impairment. *Am J Alzheimers Dis Other Demen*. 2017;32:479–88.
21. Aguinaga S, Marquez DX. Impact of Latin dance on physical activity, cardiorespiratory fitness, and sedentary behavior among Latinos attending an adult day center. *J Aging Health*. 2019;31:397–414.
22. Ahmad J, Okwuowulu C, Sanusi B, Bello SA, Talabi FO, Udengwu N, Gever VC. Impact of social media-based dance therapy in treating depression symptoms among victims of Russia-Ukraine war. *Health Promot Int*. 2022;37.
23. Ai H, Okada R, Sakura M, Wachtler T, Ikeno H. Neuroethology of the waggle dance: how followers interact with the waggle dancer and detect spatial information. *Insects*. 2019;10.

24. Kshtriya S, Barnstaple R, Rabinovich DB, DeSouza JFX. Dance and aging: a critical review of findings in neuroscience. *Am J Dance Ther.* 2015;37:81–112.
25. Zhu Y, Gao Y, Guo C, Qi M, Xiao M, Wu H, Ma J, Zhong Q, Ding H, Zhou Q, Ali N, Zhou L, Zhang Q, Wu T, Wang W, Sun C, Thabane L, Zhang L, Wang T. Effect of 3-month aerobic dance on hippocampal volume and cognition in elderly people with amnesic mild cognitive impairment: a randomized controlled trial. *Front Aging Neurosci.* 2022;14:771413.
26. Zinelabidine K, Elghoul Y, Jouira G, Sahli S. The effect of an 8-week aerobic dance program on executive function in children. *Percept Mot Skills.* 2022;129:153–75.
27. Teixeira-Machado L, Arida RM, de Jesus MJ. Dance for neuroplasticity: a descriptive systematic review. *Neurosci Biobehav Rev.* 2019;96:232–40.
28. • Verghese J, Lipton RB, Katz MJ, Hall CB, Derby CA, Kuslansky G, Ambrose AF, Sliwinski M, Buschke H. Leisure activities and the risk of dementia in the elderly. *N Engl J Med.* 2003;348:2508–16. The Journal is the most highly cited.
29. Koch SC, Riege RFF, Tisborn K, Biondo J, Martin L, Beelmann A. Effects of dance movement therapy and dance on health-related psychological outcomes. A Meta-Analysis Update. *Front Psychol.* 2019;10:1806. <https://doi.org/10.3389/fpsyg.2019.01806>.
30. Halprin A. *Dance as a healing art: Returning to health through movement & imagery.* Mendocino, CA: LifeRhythm. 2000, pp. 196.
31. Jingle. 2023. <https://www.dreamstime.com/stock-photo-young-powwow-jingle-dress-dancer-image12914520>. Accessed 1/2/23.
32. Guozhang. 2023. [https://www.dreamstime.com/search.php?securitycheck=f9285f61fc7cba9ba9126ddc1d7432e&firstvalue=&lastsearchvalue=&srh\\_field=guozhuang&s\\_ph=y&s\\_il=y&s\\_video=y&s\\_audio=y](https://www.dreamstime.com/search.php?securitycheck=f9285f61fc7cba9ba9126ddc1d7432e&firstvalue=&lastsearchvalue=&srh_field=guozhuang&s_ph=y&s_il=y&s_video=y&s_audio=y). Accessed 1/2/23.
33. Edwards JE, Oldman AD, Smith LA, Carroll D, Wiffen PJ, McQuay HJ, Moore AR. Oral aspirin in postoperative pain: a quantitative systematic review. *Pain* 1999;81:289–97.

## Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.